

## Claims

1. A device for cooling, comprising
  - a) a diode, comprising an emitter and a collector electrode;
  - b) a substance from which heat is to be removed, and a substance to which heat is to be transferred, respectively thermally connected to said emitter and said collector electrodes;
  - c) positioning means for spatially positioning at least one of said electrodes relative to the other;
  - d) an electrical circuit between said emitter and collector; and
  - e) means for providing a voltage bias to said emitter to cause emission of electrons, whereby said emitter is cooled.
2. The device of claim 1 further comprising measuring means to enable the measurement of the distance separating said electrodes.
3. The device of claim 2 wherein said measuring means is selected from the group consisting of: apparatus for measuring capacitance, apparatus for measuring tunneling current, and optical interferometry.
4. The device of claim 1 wherein said positioning means is selected from the group consisting of: piezo-electric, electrostrictive, and magnetostrictive actuators.
5. The device of claim 1 wherein said positioning means comprises multiple actuators.
6. The device of claim 5 comprising means for controlling said multiple actuators independently.
7. The apparatus of claim 1 wherein a region between said electrodes is evacuated.
8. The apparatus of claim 1 wherein a region between said electrodes comprise an inert gas.
9. The apparatus of claim 8 wherein said inert gas is argon.
10. The apparatus of claim 1 wherein said distance separating said emitter electrode and said collector electrode is sufficiently small for electrons to tunnel from said emitter electrode to said collector electrode.
11. A method for pumping heat between an emitter electrode and a collector electrode of a gap diode device, comprising:

- d) positioning said emitter electrode and said collector electrode to within 200 angstroms of each other by positioning means for spatially positioning at least one of said electrodes relative to the other;
  - e) causing electrons to tunnel between said emitter electrode and said collector electrode by applying a suitable voltage bias to said emitter electrode.
12. The method of claim 11 further comprising the step of measuring the distance separating said electrodes using measurement means selected from the group consisting of: apparatus for measuring capacitance, apparatus for measuring tunneling current, and optical interferometry.
13. The method of claim 11 wherein said positioning means is selected from the group consisting of: piezo-electric, electrostrictive, and magnetostrictive actuators.
14. The method of claim 11 wherein said positioning means comprises multiple actuators.
15. Apparatus for the conversion of energy comprising:
- a) a source of energy;
  - b) an emitter electrode able to emit electrons connected to said source of energy;
  - c) a collector electrode,
  - d) an electrical circuit connecting said electrodes;
- wherein said emitter electrode and said collector electrode each comprise a surface for positioning facing the other, wherein topographical features of said emitter electrode surface match topographical features of said collector electrode surface.
16. The apparatus of claim 15 wherein a region between said electrodes is evacuated.
17. The apparatus of claim 15 wherein a region between said electrodes comprise an inert gas.
18. The apparatus of claim 17 wherein said inert gas is argon.
19. The apparatus of claim 15 wherein a distance separating said emitter electrode and said collector electrode is sufficiently small for electrons to tunnel from said emitter electrode to said collector electrode.

20. A method for reducing thermal conduction between two or more layers of a device comprising placing said two or more layers in sufficiently close proximity that the separation of said layers is less than the free mean path of electrons in an atmosphere between said layers, wherein said two or more layers each comprise a surface for positioning facing the other, wherein topographical features of one surface match topographical features of other surface.